Heavy Timber Construction

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PDH: 3

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Module 1: General

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the fundamental design principles that define Type IV Heavy Timber construction.
- **Evaluate** the relationship between member mass, assembly details, and inherent fire resistance.
- **Integrate** standard engineering design practices with the specific oversight requirements for heavy timber projects.

Executive Summary: Heavy Timber construction achieves fire resistance through the inherent thermal mass of large-section wood members and the elimination of concealed combustible spaces, rather than through applied fire-rated membranes.

Heavy Timber (HT) is a specialized construction classification where fire performance is derived from the controlled application of material mass and specific detailing. Unlike light-frame construction, which relies on protective coverings like gypsum board, HT structures utilize the "char factor" of large wood sections to maintain structural integrity during a fire.

Design Fundamentals

Core Performance Criteria

To qualify as Heavy Timber construction, the design must satisfy four primary criteria:

- **Minimum Dimensional Requirements:** You must adhere to strict limitations on the minimum sizes of wood structural members.
- **Decking Composition:** You must follow minimum thickness and composition requirements for wood floors and roofs.
- **Elimination of Concealed Spaces:** You must avoid the use of voids or concealed spaces under floors and roofs to prevent the undetected spread of fire.
- **Standardized Assembly:** Use only approved fastenings, construction details, and adhesives that meet the required fire-resistance standards.
- **Compartmentalization:** Ensure exterior and interior walls provide the specific degree of fire resistance required by the local building code.

⚠️ **Safety Constraint:** Heavy Timber design relies on the precise execution of details. This document must be used in conjunction with competent engineering design, accurate fabrication, and rigorous construction supervision to ensure the safety and fire-performance of the structure.

💡 **Design Tip:** As an engineer, always verify your design against the current edition of the building code and consult the authority having jurisdiction (AHJ) early in the design process to confirm Type IV compliance.

Checkpoint Quiz

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1. **Heavy Timber construction differs from light-frame construction primarily because fire resistance is achieved through:**
   a) Fire-retardant chemical coatings applied to all surfaces.
   b) The use of minimum member sizes and the elimination of concealed spaces.
   c) Enclosing all wood members within 1-hour fire-rated assemblies.
   d) Using only non-combustible fasteners and metal plates.

Answer: (b). Heavy Timber relies on dimensional mass and the avoidance of concealed spaces to achieve fire resistance.

2. **Which of the following is a mandatory requirement for maintaining the fire-resistance integrity of a Heavy Timber structure?**
   a) Ensuring all floor joists are spaced no more than 16 inches on center.
   b) Providing at least a 2-inch air gap between all structural members.
   c) Avoiding concealed spaces under floors and roofs.
   d) Using only heartwood for all interior columns and beams.

Answer: (c). The avoidance of concealed spaces is a critical requirement to prevent fire from spreading throughout the structure undetected.

3. **According to the manual, the accuracy of a Heavy Timber design is the responsibility of:**
   a) The American Forest & Paper Association.
   b) The publisher of the WCD No. 5.
   c) The engineering designer and those using the document.
   d) The manufacturer of the wood adhesives.

Answer: (c). Those using the document assume all liability from its use; the association does not assume responsibility for specific engineering designs or plans prepared from it.

Module 2: Materials

Learning Objectives

By the end of this section, you will be able to:

- **Select** appropriate wood species or treatments based on environmental exposure and decay resistance requirements.
- **Verify** compliance of sawn lumber and glued laminated timber with industry-standard grading rules.
- **Identify** the authoritative rules-writing agencies responsible for wood quality standards across North America.

Executive Summary: Heavy Timber construction requires structural members to meet strict grading standards for strength and fire performance, with mandatory preservation measures for any components exposed to the elements.

Material Quality and Durability

Decay Resistance Standards

Durability is a critical factor for structural integrity in Heavy Timber systems, particularly regarding moisture exposure.

- **Weather Exposure:** Structural members exposed to weather must be preservatively treated.
- **Natural Durability:** As an alternative to treatment, you may use the heartwood of a naturally durable wood species.

Sawn Lumber Grading Rules

All lumber used for heavy timber framing and decking must be graded according to the specific rules under which the species is customarily classified. You should consult the following agencies for specific grading criteria:

Agency	Standard / Grading Rule
NELMA	Standard Grading Rules for Northeastern Lumber
RIS	Standard Specifications for Grades of California Redwood Lumber
SPIB	Standard Grading Rules for Southern Pine Lumber
WCLIB	Standard Grading Rules for West Coast Lumber, No. 17
WWPA	Western Lumber Grading Rules
NLGA	NLGA Standard Grading Rules for Canadian Lumber

⚠️ **Safety Constraint:** You shall ensure that all lumber used in framing and decking is graded in accordance with the customary rules for that species to guarantee the structural and fire-resistance properties assumed in your design.

Structural Glued Laminated Timber

Glued laminated timber (glulam) provides engineered performance for heavy timber applications. The following standards govern their manufacture and specifications:

- **ANSI/AITC A190.1-1992:** American National Standard for Structural Glued Laminated Timber.
- **AITC 117-2001:** Standard Specifications for Structural Glued Laminated Timber of Softwood Species.
- **APA EWS Technical Note Y117:** Technical guidance for glulam applications.

💡 **Design Tip:** When specifying glued laminated timber, always reference the most current AITC or APA standards to ensure the material meets modern engineering requirements for stress-rated applications.

Checkpoint Quiz

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1. **A structural heavy timber column is designed to be located on an exterior patio exposed to rain. According to code requirements, this member must be:**
   a) Painted with at least two coats of exterior-grade oil-based paint.
   b) Preservatively treated or sourced from the heartwood of a naturally durable species.
   c) Sized 2 inches larger than the minimum nominal requirement.
   d) Wrapped in a non-combustible moisture barrier.

Answer: (b). Structural members exposed to weather shall be preservatively treated or be from the heartwood of a naturally durable wood.

2. **Which organization would you contact to obtain the grading rules for Southern Pine used in heavy timber framing?**
   a) WCLIB
   b) NELMA
   c) SPIB
   d) WWPA

Answer: (c). The Southern Pine Inspection Bureau (SPIB) writes the "Standard Grading Rules for Southern Pine Lumber".

3. Structural glued laminated timber (glulam) must conform to which of the following standards?

a) ANSI/AITC A190.1
b) ASTM E119
c) NFPA 211
d) AWC WCD No. 2

Answer: (a). Glulam must be manufactured in accordance with ANSI/AITC A190.1-1992.

Purchase this course to see the remainder of the technical materials.